MULTIMEDIA QUERY SYSTEM USING NON-UNIFORM BIN QUANTIZATION OF ~~COLOR~~A HISTOGRAM

BACKGROUND OF THE INVENTION

~~1. Field~~1. Field of the Invention

[] The present invention generally relates to a multimedia query using a~~color histogram, and more particularly, to a method for configuring a color histogram which provides interoperability between color histograms configured by non-uniform bin quantization using bits of a different number, and provides progressive bit processingfor keeping a constant performance even when using the front parts of total bits of each bin value in the order of time series.~~

~~2. Description of the Related Art~~

~~Recently, as content-based multimedia query techniques are coming to the front, the study of multimedia features affecting a query performance is being made actively. Most frequently used search engines at present use global and local color information and texture information for image retrieval. Among them, the color information is known as an element mostly affecting the image retrieval. Thus, the development of more effective color features is being made, and also an attempt to develop color spaces more effective to the retrieval is being made.~~

~~A color histogram is most widely used as color information. The color histogram is information representative of color distribution of multimedia data such as images. A bin number of the histogram is determined according to how the color space is quantized. Although each bin value is represented by a decimal mostly, it also can be represented by N bits smaller than a fractional representation space for more improved performance and spatial efficiency. For example, it is generally known that spaces can be saved substantially without degradation of~~

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performance by representing 8 bits, i.e., decimals between 0 and 1, by 256 kinds of values. In a uniform quantization method, values between 0 and 1 are divided by a uniform width, quantized and represented, while, in a non-uniform quantization method, they are divided by a non-uniform width, quantized and represented.

In case of using the non-uniform quantization method, it is possible to implement an improved performance as compared to the case of using the uniform quantization method or representing a decimal as it is. For instance, a section of an important bin value is divided more finely, while a section of a value having no division ability is divided less finely, for thereby enhancing the performance. For example, in case of a histogram, most bin values consists of a number smaller than 0.2, and thus it is meaningless to divide a number more than 0.2 finely. For this reason, the bin quantization using non-uniform quantization can be employed very usefully, but it may lead to the following problems.

Problem of interoperability : Firstly, it is difficult to compare bin values each quantized by a different number. For example, a certain histogram quantizes and represents a bin value by 2^4=16 in order to represent each bin value by 4 bits, while another histogram quantizes a bin value by 2^2=4 in order to represent each bin value by 2 bits. Then, the comparison of these values is made impossible if there is no information about the method for quantization of each bin value. Therefore, it is necessary to ensure interoperability by which the comparison of bin values quantized by a different number by using a quantization method conforming to a particular protocol.

1. **Problem of progressive bit processing: when a color histogram is transferred through a network, it can be transferred in the order of bins according to the coding scheme of the color histogram, or in the order of bits of the bin. In case of transferring the color histogram in the order of bins, every bits of the first bin are transferred and thereafter the next bin is transferred. In case of transferring the color histogram in the order of bits, the first bit of the first bin is transferred and then the first bit of the second bin is transferred. In this way,**

~~after every first bits representing each bin value are transferred, every second bits representing each bin valueare transferred. In such a coding scheme, if the transfer is interrupted before the histogram is completely transferred, the comparison of the histogram has to be enabled only by the transferred part of the~~ histogram.

~~SUMMARY OF THE INVENTION~~

~~It is, therefore, an object of the present invention to provide a multimedia query using a color histogram which enables comparison between histograms non-uniform bin quantized by a different number of bits, and also enables comparison between histograms by using the front parts of the histogram in the order of transfer when the histogram is transferred in the order of bits.~~

~~To achieve the above object, a color histogram in accordance with the present invention is provided, which comprises threshold values used in representing the number of n of bits for securing interoperability, capable of comparing the histograms represented by bits of a different number, including necessarily threshold values used in representing the number of N'(N'<N) of bits, when bin value is represented with the number of N of bits by quantization in order to query multimedia using color histogram.~~

~~In addition, there is provided a multimedia query method in accordance with the present invention, which comprises the steps of: correcting the other bin value as smaller number of N of bits and then comparing two values, if one of two histograms represents bin value with M, the other represents bin value with N(M>N), when performing the comparison between histograms represented with the number of bits which are differ from each other.~~

~~Preferably, there is provided a multimedia query method in accordance with the present invention, wherein the correcting is performed by adding the bin values divided by the threshold values (TH1s) existing between two threshold values used in representing the number of N of bits to the rest threshold values except for threshold values (TH2s) used in representing the~~

~~number of N of bits, among threshold values (TH1s) used in representing the number of M of bits.~~

~~In addition, there is provided a color histogram quantization method in accordance with the present invention, which comprises the steps of: dividing HMMD color space by a color histogram, the color histogram comprising threshold values used in representing the number of n of bits for securing interoperability, capable of comparing the histograms represented by the number of bits which are differ from each other, including necessarily threshold values used in representing the number of N'(N'<N) of bits, when bin value is represented with the number of N of bits by quantization in order to query multimedia using color histogram, at this time, (a) producing indexes of two bin values by using a threshold value 2.5/310.0 for representing 1 bit bin value; (b) producing indexes of four bin value by using three threshold values 2.5/310.0, 9.1/310.0, and 30.0/310.0 for representing 2 bits bin values; (c) producing 16 indexes by deciding 0.0 of bin value as an index for representing 4 bits bin values, producing two indexes by bisecting a period of 0 and 0.6/310.0, producing an index in the period of 0.6/310.0 and 2.5/310.0, producing five indexes in the periods of 2.5/310.0 and 19.0/310.0, producing six indexes in the periods of 19.0/310.0 and 85.0/310.0, and designating the value above 85.0/310.0 as an index; and (d) producing an index by deciding 0.0 of bin value as an index for representing 6 bits bin values, producing four indexes by diving a period of 0 and 0.6/310.0 into four equal parts, producing four indexes by diving the period of 0.6/310.0 and 2.5/310.0 into four equal parts, producing ten indexes by dividing the periods of 2.5/310.0 and 19.0/310.0 into ten equal parts, producing thirty indexes by dividing the periods of 19.0/310.0 and 85.0/310.0 into thirty equal parts, producing fourteen indexes by dividing the periods of 85.0/310.0 and 121.0/310.0 into fourteen equal parts, and designating the value above 121.0/310.0 as an index.~~

~~In addition, there is provided a color histogram in accordance with the present invention, which comprises n-th bit represented by quantization of bin value, wherein the nth bit bisects the respective regions divided into (N-1)th bit in order to perform a progressive bit processing capable of retrieving by using only a bit, which is smaller than N, when bin value is represented with the number of N of bits by quantization in order to query multimedia using color histogram.~~

~~Preferably, there is provided a color histogram encoding method in accordance with the~~

~~present invention, which comprises the steps of: arranging firstly the first bit of every bin; and arranging the second bit, when encoding the histogram representing bin value capable of a progressive bit processing.~~

~~Preferably, there is provided a multimedia query system in accordance with the present invention in which only a portion of the histogram is used according to the use of query and environment of a client, thereby capable of performing the optimum query.~~

~~BRIEF DESCRIPTION OF THE DRAWINGS~~

~~The above objects, features and advantages of the present invention will become more apparent from the following detailed description when taken in conjunction with the accompanying drawings, in which:~~

~~Fig. 1 is a view explaining an example of bin quantization which is interoperable;~~

~~Fig. 2 is a view explaining a phase in which multimedia data represented as a color histogram are transferred in the order of bit priority;~~

~~Fig. 3 is a view explaining a partial query using a color histogram of which transfer is interrupted;~~

~~Fig. 4 is a view explaining the relationship between a threshold and color histogram data;~~

~~**Fig. 5 is a view illustrating a HMMD color space to which the present invention is adapted; and**~~2. Background of the Related Art

1 [] Images or pictures can be stored on a computer in digital form. Utilizing digital images is becoming increasingly popular. This popularity may be attributed to the low cost of producing digital images as compared to images taken with a conventional camera using film. One advantage is digital images can be distributed electronically via the Internet. Another attribute is that there is no incremental cost per image to produce the digital image by digital camera. Accordingly, a user of a digital camera may tend to take many pictures.

Further, there is an enormous amount of digital images available to users via the Internet. It is often a great task for a user to locate a digital image through a search. Accordingly, search engines exist for searching for digital images. However, these search engines suffer from at least two disadvantages. One disadvantage is that not all images are represented in the same way for purposes of the search. For example, two images may be represented by a histogram for searching purposes, however the histograms utilize different protocols which are not compatible. Another disadvantage is that data relating to an image (i.e., a histogram) may be only partially transferred between computers on a network and cause that partial transfer of the histogram to be useless.

SUMMARY OF THE INVENTION

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Objects of the present invention at least include overcoming the above-discussed disadvantages. Particularly, embodiments of the present invention allows for increased compatibility between two histograms and allows for a portion of a histogram to be utilized in a query.

3 [] Embodiments of the present invention relate to a method for receiving a first sequence of values and a second sequence of values. Each value in the first sequence and each value in the second sequence is associated with a category and a magnitude. In embodiments of the present invention, the magnitudes are thresholds. In embodiments of the present invention the categories are bins. In embodiments of the present invention each

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value of a sequence is a bit. In the order of the values of both the first sequence of values and the second sequence of values, no adjacent values have the same category. Accordingly, in embodiments of the present invention, when a histogram is transferred or received for analysis, the order of the information in the histogram can be strategically ordered to increase compatibility of histograms and utilize partials of histograms in an image search.

4 [] In particular, when a histogram is transferred, bits are ordered or given a priority of the placement of the bits over the category that the bit is in. For example, when a histogram is transferred, the first bit of every category is transferred for the second bit of every category. In embodiments of the present invention, since each bit in the order of bits in each category is associated with a different magnitude, compatibility can be accomplished. Further, since bits are transferred according to magnitude and not according to a category, the initial bits of a transferred histogram can be utilized without needing the remainder of the bits.

5 [] Additional advantages, objects, and features of the invention will be set forth in part in the description which follows and in part will become apparent to those having ordinary skill in the art upon examination of the following or may be learned from practice of the invention. The objects and advantages of the invention may be realized and attained as particularly pointed out in the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

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Fig. 1 is a view explaining an example of bin quantization which is interoperable.

7 [] Fig. 2 is an exemplary view explaining a phase in which multimedia data represented as a histogram are transferred in the order of bit priority.

8 [] Fig. 3 is an exemplary view explaining a partial query using a histogram of which transfer is interrupted.

9 [] Fig. 4 is an exemplary view explaining the relationship between a threshold and histogram data.

~~11~~10 [] Fig. 5 is an exemplary view illustrating a HMMD color space.

~~12~~11 ~~**Fig. 6 is a view explaining a 184 level quantization method viewed in a MMD**~~[]

Fig. 6 is an exemplary view explaining a 184 level quantization method viewed in a HMMD cross-section.

~~DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENT~~

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

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~~**A method for configuring a color histogram non-uniform bin quantized and**~~The following detailed description of embodiments of the present invention depicts only histograms for the purpose of exemplary illustrating the method of a multimedia query using the histogram. The present invention can be equally effective when applied to other types of histograms.

13~~color histogram in accordance with~~ [] Search engines may use global and local color information and texture information for image retrieval. Among them, the color information is an important element in effective image query. Embodiments of the present invention relate to a color histogram. A histogram is a chart representing color distribution in multimedia data (i.e., images). A category or bin number of a histogram is determined according to how a given color space is quantized. Although each bin value may be represented by a decimal, it also can be represented by a quantity of N bits smaller than a fractional representation space. For example, it is generally known that spaces can be saved substantially without degradation of performance by representing 8 bits, i.e., decimals between 0 and 1, by 256 kinds of values. In a uniform quantization method, values between 0 and 1 are divided by a uniform width, quantized and represented, while, in a non-uniform quantization method, they are divided by a non-uniform width, quantized and represented.

14 [] In non-uniform quantization, it is possible to achieve improved performance. For instance, a section of an important bin value can be divided more finely than a section having a bin value having no divisability. For example, in case of a histogram, most bin values consists of a number smaller than 0.2, and thus it is meaningless to divide a number more finely than 0.2. In this example, bin quantization using non-uniform quantization can be effectively employed.

15~~having two objects~~[] Embodiments of the present invention overcomes problems of interoperability among histograms. It may be difficult to compare bin values that are

quantized by a different number. For example, if a certain histogram quantizes and represents a bin value by $2^4=16$ in order to represent each bin value by 4 bits, while another histogram quantizes a bin value by $2^2=4$ in order to represent each bin value by 2 bits. Then, the comparison of these values is impossible, because there is no information about the method for quantization of each bin value. Therefore, to ensure interoperability a quantization method, used by the two histograms, must conform to a particular protocol.

[] **Embodiments of the present invention overcomes problems in progressive bit processing** ~~will now be described.~~

~~1~~16of histograms. For example, when a histogram is transferred through a network, it can be transferred in the order of bins according to the coding scheme of the histogram or in the order of bits of the bin. ~~**Firstly, achievement of interoperability in accordance with the present invention will be explained.**~~When a histogram is transferred in the order of bins, every bit of the first bin are transferred and then every bit of the next bin is transferred. When a histogram is transferred in the order of bits, the first bit of the first bin is transferred and then the first bit of the second bin is transferred. For instance, after every first bit representing each bin value are transferred, every second bit representing each bin value are transferred. In such a coding scheme, if the transfer is interrupted before the histogram is completely transferred, the comparison of the histogram has to be enabled only by the transferred part of the histogram.

[] **With respect to histogram information of multimedia data, a color space can be quantized differently for** ~~various uses.~~**different purposes. Likewise,**

a bin value can be quantized differently for ~~various~~different methods for representing each bin value. For example, in a particular application, 4 bits ~~will be~~are adequate for representing a bin value, while, in another application, at least 8 bits ~~will be~~are adequate for the corresponding use. In order to calculate similarity between those applications, it is necessary to ensure the result of the comparison between them using at least the same 4 bits. However, in the non-uniform quantization, there are various quantization methods, so it is possible to compare them when the different quantization methods are ~~employed.~~

~~1~~817employed. Accordingly, ~~in~~embodiments of the present ~~invention,~~invention relate to a method for quantizing a bin value to enable interoperability between ~~them is suggested.~~histograms.

18 [] Fig. 1 is a view explaining an example of bin quantization, which is interoperable. In 101 of Fig. 1, a bin value is represented as 0 or 1 based on a particular threshold TH1 for 1 bit representation. A histogram represented by such a method and 2 bit representation capable of direct comparison are described in 102 of Fig. 1. That is, a bin value is represented in four ways by using the threshold TH1 described in 101 of Fig. 1 and ~~another two thresholds TH2 and TH3. In case of comparison with a histogram represented by 1 bit,~~two additional thresholds (TH2 and TH3). Comparison between histograms 101 and 102 are possible, since the threshold TH1 ~~used in the 1 bit representation method is included as it is, the 2 bit representation can be~~ is used in both histograms.

~~corrected in the same way as the 1 bit representation by simply adding another parts. In this example, the total sum of section 2 102b, section 3 102c and section 4 102d of four sections 102a, 102b, 102c and 102d will be the same as the representation of 101. In this way, when a~~

~~section is quantized more finely by using every thresholds used in dividing the histogram into smaller sections and another thresholds, even bin values represented by a different number of bits can be corrected and then compared by representation using bits of a smaller number.~~

19~~Next, according to the present invention, progressive bit processing will now be described. Fig.~~ [] Fig. 2 is a view explaining ~~a phase in which multimedia data represented as a color histogram are transferred in the order of bit priority.~~exemplary embodiments of the present invention. As shown in the drawing, a coding scheme can be considered in which a first bit of every bins (bin 1 ~ bin N) is transferred and then a second bit of every bit is transferred. In other words, in instead of all the bits of a bin ~~is transferred, not in the order of bins, in transferring a color histogram. In this method, in the case~~being transferred together, all the bits having the same association in the bins are transferred together. In the event that transfer is interrupted before the completion of the transfer as shown in Fig. 3, query can be executed only by transferred parts.

~~At this time, in~~ [] **In order to assure a certain degree of performance, when each bin is quantized by n bits and represented, it is necessary to represent optimum information which can be represented by each bit in the order of bits. For this purpose, the case of quantizing a bin value will be considered as follows. Firstly, assuming that a bin value is represented by 1 bit, one optimized threshold will be used to show the highest performance when the bin value is represented by two values, i.e., 0 or 1. In addition, in case of representing the bin value by 2 bits, three optimized thresholds will be used to show the highest performance when the bin value is represented by four values. At this time, if only one bit of two bits can be used, the best performance can be expected when the optimized performance achieved at the above-described 1 bit representation is obtained. Therefore, in case**

of representing the bin value by 2 bits, one of the three thresholds must be a threshold used in representing the bin value by 1 ~~bit.~~

20bit. In other words, the first bit of every bin must be associated with the same first threshold value. Accordingly, the second bit of a bin is also associated with the same second threshold value. This relationship of position in a bin and associated threshold continues throughout subsequent bits in each of the bins in a histogram.

~~22~~21 [] In addition, the first bit indicates division of a value based on the above-described threshold of 1 bit as shown in Fig. 4. The second bit indicates division of the section of the value divided by the first bit. In this way, a n-th bit indicates division of each section divided by a (N-1)-th bit.

~~23~~22 [] In other words, as ~~shown~~illustrated in Fig. 4, if a bin value is represented by 1 bit in 401, it is divided based on a threshold Th1. If the bin value is represented by 2 bits in 402, each of sections divided by the threshold Th1 is divided again by the previously used threshold Th1 and another thresholds Th2 and Th3. If the bin value is represented by three bits in 403, each of sections divided by the previously used thresholds Th1, Th2 and Th3 and another thresholds Th4, Th5, Th6 and Th7. In this manner, when the bin value is quantized and represented by a small number of bits so that progressive bit processing can be achieved, a certain degree of query performance can be assured by using only transferred parts even though transfer is interrupted during the transfer of a histogram. Moreover, bin values of the histogram can be queried by using only parts of total bits according to the use of the query. ~~At this time, in the present invention, even though parts of total bits are~~

~~used,~~These embodiments ~~they represent every information of the entire color bins and thus a good performance can be expected.~~of the present invention allow for adequate query performance, even though all bits of a histogram are not utilized.

~~2~~423 [] Fig. 5 describes a HMMD color space for explaining a progressive~~color~~ histogram using the HMMD color space in accordance with ~~the embodiment~~embodiments of the present invention. The HMMD color space is a color space of a double cone shape. The HMMD color space is described in U.S. Application Serial Nos. 09/239,773 filed April 29, 1999 and 09/865,459 filed May 29, 2001, which is assigned to the same entity, and the entire disclosure thereof is incorporated herein by reference. The central axis thereof is represented as SUM ([MAX(RGB) + MIN(RGB)]/2), which corresponds to brightness. Fineness is increased in the order of center to peripheral sides of the cone, which is represented as DIFF(MAX(RGB)-MIN(RGB)). The angle of the cone indicates a color, which is generally represented as Hue.

[] Fig. 6 illustrates an example of 184 level quantization of the HMMD color space explained in Fig. ~~5.~~

~~2~~5245. As shown in Figure 6, first, a region is divided into 5 partial regions on the basis of DIFF and then subdivided on the basis of HUE and SUM again, thereby representing 184 partial regions in all. These produce a~~color~~ histogram constituted by 184 bins, respectively, as follows. First, indexes of two bin values by using a threshold value 2.5/310.0 for representing 1 bit bin value are produced. Thereafter, indexes of four bin values by using three threshold values 2.5/310.0, 9.1/310.0, and 30.0/310.0 for representing 2 bits bin

values are produced. Also, 16 indexes by deciding 0.0 of bin value as an index for representing 4 bits bin values, producing two indexes by bisecting a period of 0 and 0.6/310.0, producing an index in the period of 0.6/310.0 and 2.5/310.0, producing five indexes in the periods of 2.5/310.0 and 19.0/310.0, producing six indexes in the periods of 19.0/310.0 and 85.0/310.0, and designating the value above 85.0/310.0 as an index are produced. On the other hand, an index by deciding 0.0 of bin value as an index for representing 6 bits bin values, producing four indexes by diving a period of 0 and 0.6/310.0 into four equal parts, producing four indexes by diving the period of 0.6/310.0 and 2.5/310.0 into four equal parts, producing ten indexes by dividing the periods of 2.5/310.0 and 19.0/310.0 into ten equal parts, producing thirty indexes by dividing the periods of 19.0/310.0 and 85.0/310.0 into thirty equal parts, producing fourteen indexes by dividing the periods of 85.0/310.0 and 121.0/310.0 into fourteen equal parts, and designating the value above 121.0/310.0 as an index is produced.

25 [] Embodiments of the present invention relate to a histogram. The histogram may include the following attributes. Threshold values used in representing the number of n of bits for securing interoperability, capable of comparing the histograms represented by the number of bits which are differ from each other, including threshold values used in representing the number of N'(N'<N) of bits,

when bin value is represented with the number of N of bits by quantization in order to query multimedia using histogram. The histogram is a histogram.

26 [] Embodiments of the present invention relate to a multimedia query method. The method may include correcting the other bin value as smaller number of N of bits and then comparing two values if one of two histograms represents bin value with M, the other represents bin value with N(M>N), when performing the comparison between histograms represented with the number of bits which are differ from each other. The correcting process may be performed by summing the bin values divided by the threshold values (TH1s) existing between two threshold values used in representing the number of N of bits to the rest threshold values except for threshold values (TH2s) used in representing the number of N of bits, among threshold values (TH1s) used in representing the number of M of bits. The histogram may be a histogram.

27 [] Embodiments of the present invention relate to a histogram quantization method. The method may comprise the

following steps. Dividing HMMD color space by a histogram, the histogram comprising threshold values used in representing the number of n of bits for securing interoperability, capable of comparing the histograms represented by the number of bits which are differ from each other, including necessarily threshold values used in representing the number of N'(N'<N) of bits, when bin value is represented with the number of N of bits by quantization in order to query multimedia using histogram, at this time. Producing indexes of two bin values by using a threshold value 2.5/310.0 for representing 1 bit bin value. Producing indexes of four bin values by using three threshold values 2.5/310.0, 9.1/310.0, and 30.0/310.0 for representing 2 bits bin values. Producing 16 indexes by deciding 0.0 of bin value as an index for representing 4 bits bin values, producing two indexes by bisecting a period of 0 and 0.6/310.0, producing an index in the period of 0.6/310.0 and 2.5/310.0, producing five indexes in the periods of 2.5/310.0 and 19.0/310.0, producing six indexes in the periods of 19.0/310.0 and 85.0/310.0, and

designating the value above 85.0/310.0 as an index. Producing an index by deciding 0.0 of bin value as an index for representing 6 bits bin values, producing four indexes by diving a period of 0 and 0.6/310.0 into four equal parts, producing four indexes by diving the period of 0.6/310.0 and 2.5/310.0 into four equal parts, producing ten indexes by dividing the periods of 2.5/310.0 and 19.0/310.0 into ten equal parts, producing thirty indexes by dividing the periods of 19.0/310.0 and 85.0/310.0 into thirty equal parts, producing fourteen indexes by dividing the periods of 85.0/310.0 and 121.0/310.0 into fourteen equal parts, and designating the value above 121.0/310.0 as an index.

28 [] Embodiments of the present invention relate to a histogram. The histogram includes n-th bit represented by quantization of bin value, wherein the nth bit bisects the respective regions divided into (N-1)th bit in order to perform a progressive bit processing capable of retrieving by using only a bit, which is smaller than N, when bin value is represented with the number of N of bits by

quantization in order to query multimedia using histogram. The histogram may be a histogram.

29 [] Embodiments of the present invention relate to a histogram encoding method. The method may include arranging the first bit of every bin first and then arranging the second bit, when encoding the histogram representing bin value to perform the progressive bit processing. The histogram may be a histogram.

~~31~~30 [] In the present invention, in a multimedia query using a~~color~~ histogram, free comparative query between every servers on the internet, not one server, is enabled by providing interoperability by which comparative query between histograms bin quantized by different number of bits, when considering spatial efficiency by representing a bin value by bits of a decimal. In addition, when the bin value is quantized and represented by a limited number of bits, a certain degree of query performance can be expected by executing query using only parts of the bits, for thereby enabling query at the time of transfer interrupt caused by a problem on a network and performing a query service conforming to the use of the query or the environment of a client.

~~What Is Claimed Is:~~

~~1. A color histogram comprising;~~

~~threshold values used in representing the number of n of bits for securing~~

~~interoperability, capable of comparing the histograms represented by the number of bits which are differ from each other, including necessarily threshold values used in representing the number of N'(N'<N) of bits, when bin value is represented with the number of N of bits by quantization in order to query multimedia using color histogram.~~

~~2. A multimedia query method comprising the steps of:~~

~~correcting the other bin value as smaller number of N of bits and then comparing two values if one of two histograms represents bin value with M, the other represents bin value with N(M>N), when performing the comparison between histograms represented with the number of bits which are differ from each other.~~

~~3. The multimedia query method according to claim 2, wherein the correcting process is performed by adding the bin values divided by the threshold values (TH1s) existing between two threshold values used in representing the number of N of bits to the rest threshold values except for threshold values (TH2s) used in representing the number of N of bits, among threshold values (TH1s) used in representing the number of M of bits.~~

~~4. A color histogram quantization method comprising the steps of:~~

~~dividing HMMD color space by a color histogram, the color histogram comprising threshold values used in representing the number of n of bits for securing interoperability, capable of comparing the histograms represented by the number of bits which are differ from each other, including necessarily threshold values used in representing the number of N'(N'<N) of bits, when bin value is represented with the number of N of bits by quantization in order to query multimedia using color histogram, at this time,~~

~~(a) producing indexes of two bin values by using a threshold value 2.5/310.0 for representing 1 bit bin value;~~

~~(b) producing indexes of four bin values by using three threshold values 2.5/310.0, 9.1/310.0, and 30.0/310.0 for representing 2 bits bin values;~~

~~(c) producing 16 indexes by deciding 0.0 of bin value as an index for representing 4~~

~~bits bin values, producing two indexes by bisecting a period of 0 and 0.6/310.0, producing an index in the period of 0.6/310.0 and 2.5/310.0, producing five indexes in the periods of 2.5/310.0 and 19.0/310.0, producing six indexes in the periods of 19.0/310.0 and 85.0/310.0, and designating the value above 85.0/310.0 as an index; and~~

~~(d) producing an index by deciding 0.0 of bin value as an index for representing 6 bits bin values, producing four indexes by diving a period of 0 and 0.6/310.0 into four equal parts, producing four indexes by diving the period of 0.6/310.0 and 2.5/310.0 into four equal parts, producing ten indexes by dividing the periods of 2.5/310.0 and 19.0/310.0 into ten equal parts, producing thirty indexes by dividing the periods of 19.0/310.0 and 85.0/310.0 into thirty equal parts, producing fourteen indexes by dividing the periods of 85.0/310.0 and 121.0/310.0 into fourteen equal parts, and designating the value above 121.0/310.0 as an index.~~

~~5. A color histogram comprising;~~

~~n-th bit represented by quantization of bin value, wherein the nth bit bisects the respective regions divided into (N-1)th bit in order to perform a progressive bit processing capable of retrieving by using only a bit, which is smaller than N, when bin value is represented with the number of N of bits by quantization in order to query multimedia using color histogram.~~

~~6. A color histogram encoding method comprising the steps of:~~

~~arranging the first bit of every bin first and then arranging the second bit, when encoding the histogram representing bin value to perform the progressive bit processing.~~

2. [] The foregoing embodiments and advantages are merely exemplary and are not to be construed as limiting the present invention. The present teaching can be readily applied to other types of apparatuses. The description of the present invention is intended to be illustrative, and not to limit the scope of the claims. Many alternatives, modifications, and variations will be apparent to those skilled in the art.

WHAT IS CLAIMED IS:

1. A method comprising:

receiving a first sequence of values and a second sequence of values, wherein:

each value of the first sequence and each value of the second sequence is associated with a category and a magnitude, and

in the order of values of both the first sequence of values and the second sequence of values, no adjacent values have the same category.

2. The method of claim 1, comprising comparing a value of the first sequence with a value of the second sequence if the value of the first sequence and the value of the second sequence are associated with the same category and same magnitude.

3. The method of claim 1, wherein the magnitude is a threshold.

4. The method of claim 1, wherein the category is a bin.

5. The method of claim 1, wherein each value of a sequence of values is a bit.

6. The method of claim 1, wherein at least one of the first sequence of values and the second sequence of value is data from a histogram.

7. The method of claim 6, wherein the histogram is a color histogram.

8. The method of claim 1, wherein in the order of values of both the first sequence of values and the second sequence of values, values associated with the same magnitude are grouped together in groups.

9. The method of claim 8, wherein the order of the groups is according to resolution of information of each value of each group.

10. The method of claim 1, wherein in the order of values of both the first sequence of values and the second sequence of values, each value is associated with a resolution equal to or higher than the preceding value.

11. An apparatus configured to:

receive a first sequence of values and a second sequence of values, wherein:

each value of the first sequence and each value of the second sequence is associated with a category and a magnitude, and

in the order of values of both the first sequence of values and the second sequence of values, no adjacent values have the same category.

12. The apparatus of claim 11, configured to compare a value of the first sequence with a value of the second sequence if the value of the first sequence and the value of the second sequence are associated with the same category and same magnitude.

13. The apparatus of claim 11, wherein the magnitude is a threshold.

14. The apparatus of claim 11, wherein the category is a bin.

15. The apparatus of claim 11, wherein each value of a sequence of values is a bit.

16. The apparatus of claim 11, wherein at least one of the first sequence of values and the second sequence of value is data from a histogram.

17. The apparatus of claim 16, wherein the histogram is a histogram.

18. The apparatus of claim 11, wherein in the order of values of both the first sequence of values and the second sequence of values, values associated with the same magnitude are grouped together in groups.

19. The apparatus of claim 18, wherein the order of the groups is according to resolution of information of each value of each group.

20. The apparatus of claim 11, wherein in the order of values of both the first sequence of values and the second sequence of values, each value is associated with a resolution equal to or higher than the preceding value.

ABSTRACT OF THE DISCLOSURE

~~The present invention relates to a multimedia query using a color histogram, and more particularly, to a method for configuring a color histogram which provides interoperability between color histograms configured by non-uniform bin quantization using bits of a different number, and provides progressive bit processing for keeping a constant performance even when using the front parts of total bits of each bin value in the order of time series.~~

~~**A color histogram includes threshold values used in representing the number of n of bits for securing interoperability, capable of comparing the histograms represented by the number of bits which are differ from each other, including necessarily threshold values used in representing the number of N'(N'<N) of bits, when bin value is represented with the number of N of bits by quantization in order to query multimedia using color histogram. Also, the color histogram includes n-th bit represented by quantization of bin value, wherein the nth bit bisects the respective regions divided into (N-1)th bit in order to perform a progressive bit processing capable of retrieving by using only a bit, which is smaller than N, when bin value is represented with the number of N of bits by quantization in order to query multimedia using color histogram.**~~Embodiments of the present invention relate to a method for receiving a first sequence of values and a second sequence of values. Each value in the first sequence and each value in the second sequence is associated with a category and a magnitude. In embodiments of the present invention, the magnitudes are partial. In embodiments of the present invention the categories are bins. In embodiments of the present invention each value of a sequence is a bit. In the order of the values of both the first sequence of values and the second sequence of values, no adjacent bodies have the same category. Accordingly, in embodiments of the present invention, when a histogram is transferred or received for analysis, the order of the information in the histogram can be strategically ordered to increase compatibility of histograms and utilize partials of histograms in an image search.